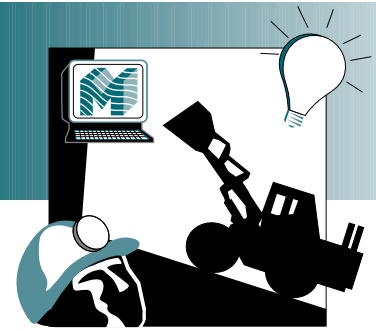


# MINING

## Project Fact Sheet



## MAGNETIC ELUTRIATION TECHNOLOGY FOR CLEAN AND EFFICIENT PROCESSING OF IRON ORE

### BENEFITS

- Greater efficiency at separating out problematic, weakly magnetic middlings particles, resulting in a cleaner, value-added iron ore product
- Process energy savings of 4.2 GWhrs at 3.5 cents per kWh, saving approximately \$150,000 per million tons of processed ore or 210 GWhrs and \$7.5 million industry-wide
- Increased iron recovery of 40,000 tons, saving \$800,000 per million tons of processed ore or 2 million tons and \$40 million industry-wide
- Eliminates 50 tons of floatation chemicals, saving \$300,000 per million tons of processed ore or 2,500 tons saving \$1.5 million industry-wide
- Total economic savings of \$1.2 million per million tons of processed ore; potential savings U.S. industry-wide of \$60 million

### APPLICATIONS

The technology was designed to benefit both Minnesota's iron ore mining industry, as well as the entire U.S. steel industry. In the future, additional uses for this innovation will be possible in industries using a separation process, including the waste processing industry in which pioneering work is being performed.



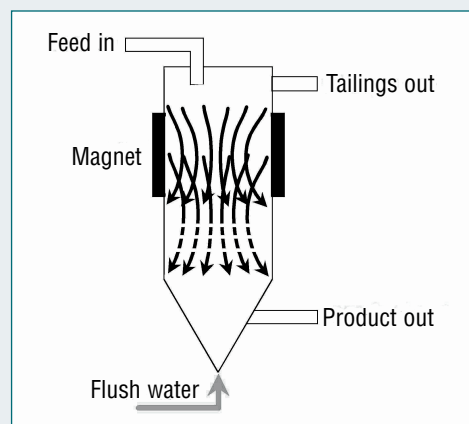
## INNOVATIVE MAGNETIC ELUTRIATION TECHNOLOGY OFFERS ENERGY, WASTE, AND ECONOMIC SAVINGS FOR THE DOMESTIC IRON ORE MINING AND STEEL INDUSTRIES

5R Research, Inc., and its project partners, are developing for commercialization a breakthrough magnetic separation technology for the iron mining industry. Conventional iron ore refining technologies require the use of harmful chemicals to wash away impurities during processing. However, a new patented magnetic elutriation process developed by 5R Research uses moving water, not chemicals, to flush away impurities and deliver a highly refined product.

This technology could answer both the short-term and longer-term threats imperiling domestic iron ore mining. First, ore reserves continue to diminish in quality, and the chemical flotation process is struggling to produce blast-furnace quality ore. In addition, the current process is inefficient, expensive, and has significant environmental impact. Magnetic elutriation technology would allow domestic mines to deliver ore that is 5 times as pure (from 5 percent down to less than 1 percent impurity) at a fraction of the price.

This advantage answers the U.S. mining industry's second challenge. U.S. steel makers must replace blast furnace steel-making facilities with new generation steel-making technologies. Currently, direct reduced iron (DRI) processes are implemented for world marketplace competitiveness. These cheaper, smaller, cleaner, and more efficient mills have much more stringent ore purity requirements than blast furnaces. The magnetic elutriation technology was specifically developed to allow U.S. mines to meet DRI mills' emerging market demand for DRI-grade ore.

### 5R RESEARCH MAGNETIC ELUTRIATOR



**This prototype of the 5R Research Magnetic Elutriator has demonstrated dramatic improvements in separation performance over previous methods. The full-scale model of this elutriator is expected to achieve highly efficient separations, while greatly increasing iron-ore quality without using harmful chemicals.**

## Project Description

**Goal:** Demonstrate and commercialize a 100 ton-per-hour magnetic elutriation device for the domestic iron ore industry.

Magnetic elutriation improves the quality of low-grade domestic iron ore by using an alternating-current, pulsed-magnetic field to clean iron ore into a highly refined product. This innovative process differs from conventional drum type magnetic separation systems by using permanent magnets that cause magnetic entrapment. Drum separators use a less effective, static magnetic field and entrap weakly-magnetic particles, known as middlings, which ultimately contaminate the iron product.

The 5R Research technology is a true continuous-counter-current design with a uniform but dynamic magnetic field throughout the system. As crude iron ore enters the system, gravity pulls the magnetically gathered iron ore particle strings downward. Only rich iron particles move downwards, while tailings particles move upwards. The selective downward movement of the product is assisted by powerful electromagnets that agitate and hold the strongly magnetic ore preventing it from being flushed out of the system. Then, water flushes the weakly magnetic middlings and sandy tailings out of the system. Highly refined iron ore is the final product. This technology is similar in concept to fluidized bed reactors currently used by the chemical processing industry.

5R Research, Inc., is demonstrating this new technology with assistance from the Evtac Mining Company, the Minnesota Department of Public Service, and the NICE<sup>3</sup> Program in the Department of Energy's Office of Industrial Technologies.

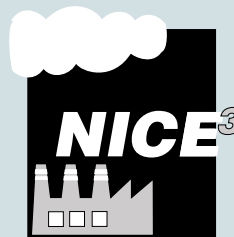
## Progress and Milestones

- Project was initiated in August 2000.
- System will be purchased and installed in February 2001.
- On-line testing of magnetic elutriator will be conducted in June 2002.
- Evaluation and final report are due in December 2002.
- Report on commercialization activities for 10 years.

## INDUSTRY OF THE FUTURE—MINING

*In mid-1998, the National Mining Association reached an agreement with the U.S. Department of Energy's Industries of the Future Program to join in creating research and development partnerships to develop and deploy new technologies that will improve environmental performance and enable the industry to meet increased global competition. The mining industry supplies the minerals and coal essential to the infrastructure of virtually the entire U.S. economy: glass, ceramics, metals, and cement for buildings, bridges, roads, and equipment, and coal or uranium to generate more than 70% of the nation's electricity.*

**OIT Mining Industry Team Leader: J. Michael Canty (202) 586-8119.**



NICE<sup>3</sup>—National Industrial Competitiveness through Energy, Environment, and Economics: An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partners for the first commercial demonstration of energy efficient and clean production manufacturing and industrial technologies.

### PROJECT PARTNERS

5R Research, Inc.  
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For project updates,  
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Order# NICE<sup>3</sup>MI-1  
October 2001